WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electric Code (ANSI C1) or any other requirements, or both, which may be applicable to the user.

Installation, operation, and maintenance should only be performed by qualified personnel.

TM-112975-1

VOLUME 1 -- OPERATOR'S MANUAL

626-PA-6030

THREE-PHASE AC GRAPHICS MONITOR

1 May 1986
(Rev. 1 Sept. 1986)
(Rev. 1 June 1987)
(Rev. 1 Sept. 1989)
(Rev. B)

See opposite side relative to proprietary rights.

Note: Refer to Volume 2 (Service Manual) of TM-112975 for maintenance information.

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HAWKER SIDDELEY DRANETZ

DRANETZ TECHNOLOGIES, INC.
1000 New Durham Rd.
Edison, New Jersey 08818

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Rev. "C" Addendum
to TM-112975

Volume 1 of 626-PA-6030

September 15, 1989

Applicability:
As of September 15, 1989, all shipments of 6030 plug-ins have been replaced with 6030G plug-ins. The 6030G has the same rear panel as the 6030, but is identified as a 6030G whenever a program summary or system check is displayed. **Note**: If you have purchased a 6030 prior to September 15, 1989, you can contact Dranetz Customer Service Department for information on updating your 6030 plug-in to a 6030G: (201) 287-3680.

Instructions:
You have been shipped a 6030G Three-Phase AC Graphics Monitor plug-in (6030G-1 or -2). The 6030G replaces its forerunner, the 6030. The 6030G is specifically designed for generating graphical displays on the Model 626G Mainframe. (Although the 6030 prints graphical displays on the 626G Mainframe, it was not originally designed for this purpose.)

To update your 6030 Operator's manual for use with the 6030G, please note the following differences in the text:

1. All references to "6030" are applicable to the 6030G.

2. All references to printing on a Graphics Printer are not necessary if you are operating in a 626G Mainframe. All graphical printouts displayed in this manual can be printed by the 626G Mainframe printer.

3. On page 1-5, last line of Table 1-1, the selectable graph size should read:

   "2-inch graphics or raw data mode."

   (The 4" selection has been replaced with raw data mode.)

4. On top of page 2-12, the first pair of printouts should read as follows:

626

```
  2 = RAW DATA
  1 = GRAPHICS
  0 = TEXT
OUTPUT TYPE:
SELECT RS232
```

626A,G

```
SELECT RS232
OUTPUT TYPE:
  0 = TEXT
  1 = GRAPHICS
  2 = RAW DATA
```

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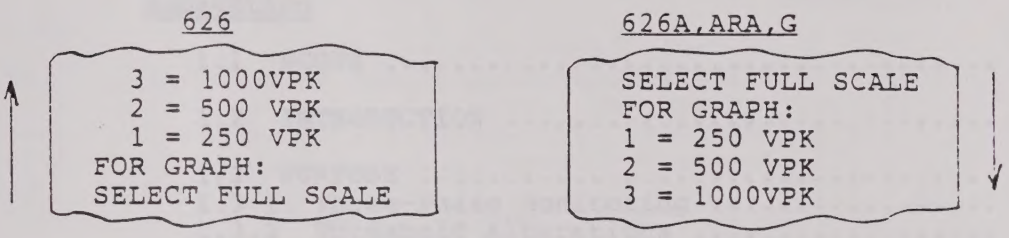
Selection 0 defaults the 6030G to printing text, selection 1 defaults it to printing text and 2" graphics, and selection 2 defaults it to printing a string of ASCII characters to an external device capable of interpreting this data.

The second pair of printouts should read as follows:



5. On page 2-14, the fourth line (Graph Size 2" 4") on the top of the page should be changed to:

   "RS232 Output Graphics Text"

6. On page 2-14, in the factory preset printouts, the voltage values should read as follows:

   V HIGH LIMIT 132 V (not 125 V)
   V LOW LIMIT 108 V (not 105 V)
   VOLTAGE SENS 003 V (not 002 V)

7. On page 2-19, under Subsection 2.9.1, the selection for graph size should read 2". (The 4" selection has been replaced with a raw data mode.)

8. Appendix A provides information on using an external graphics printer. If you are operating in a 626G Mainframe, Appendix A is only applicable if you want to display graphs on an external printer as well as the 626G Mainframe's printer.

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IMPORTANT! CALIBRATION INTERVAL

The recommended calibration interval for this unit is once every 12 MONTHS.

We recommend that you return the unit to the factory for calibration. If you decide to do so, first contact the Dranetz Customer Service Department to obtain an authorization number.

Telephone Number:	(201) 287-3680
Telex Number:	499-7808
TWX Number:	(710) 997-9553
FAX Number:	(201) 248-9240
Cable:	DRANETZ

Then fill out the Repair/Service Order form enclosed in this manual and ship it along with the unit to the Dranetz Customer Service Department. (If this form is missing, ask the Dranetz Customer Service Department for a replacement.)

STATEMENT OF WARRANTY

ALL PRODUCTS OF DRANETZ TECHNOLOGIES, INC. ARE WARRANTED TO THE ORIGINAL PURCHASER AGAINST DEFECTIVE MATERIAL AND WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM THE DATE OF DELIVERY. DRANETZ WILL REPAIR OR REPLACE, AT ITS OPTION, ALL DEFECTIVE EQUIPMENT RETURNED, FREIGHT PREPAID, DURING THE WARRANTY PERIOD, WITHOUT CHARGE FOR REPAIR, PROVIDED THERE IS NO EVIDENCE THAT THE EQUIPMENT HAS BEEN MISHANDLED OR ABUSED. THIS WARRANTY SHALL NOT APPLY TO ANY DEFECTS RESULTING FROM IMPROPER OR INADEQUATE MAINTENANCE, BUYER-SUPPLIED HARDWARE/SOFTWARE OR INTERFACING, UNAUTHORIZED MODIFICATION OR MISUSE OF THE EQUIPMENT, OPERATION OUTSIDE OF THE ENVIRONMENTAL SPECIFICATIONS FOR THE PRODUCT, OR IMPROPER SITE PREPARATION OR MAINTENANCE.

The information in this manual has been reviewed and is believed to be entirely reliable. No responsibility, however, is assumed for any inaccuracies. The material in this manual is for information purposes only, and is subject to change without notice.

VOLUME 1
OPERATOR'S MANUAL

MODEL 626-PA-6030 THREE-PHASE AC GRAPHICS MONITOR

SECTION I
GENERAL INFORMATION

1.1 SCOPE

The manual for this product consists of two volumes. Volume 1, the Operator's manual, is divided into three sections: (I) GENERAL INFORMATION, (II) INSTALLATION AND OPERATION, and (III) OPERATIONAL TEST. Volume 2, the Service manual, contains the maintenance instructions and consists of four sections, IV through VII. (See Volume 2 for a description of these sections.)

1.2 INTRODUCTION

Volume 1 of this manual provides Operator's instructions for the 626-PA-6030 Three-Phase AC Graphics Monitor plug-in module, also referred to as the 6030 plug-in. Before reading these instructions further, you should be familiar with the Mainframe information described in the Series 626 Mainframe manual.

There are two models of the 6030 plug-in: Model 626-PA-6030-1 which has barrier-type terminal strip inputs, and Model 626-PA-6030-2 which has connector inputs and mating cables. This manual is applicable to both models. Any differences in installation are noted in the text.

1.3 PURPOSE

The 6030 plug-in monitors disturbances (impulses, sags, surges, undervoltages, overvoltages, and frequency variations) on 3-phase ac power lines with either 50 or 60 Hz nominal frequency. Each phase is monitored on a single voltage range of 0 to 600V rms and 4000V pk. With user-programmable thresholds, the 6030 plug-in monitors both short- and long-term power line disturbances.

Using this plug-in, the Mainframe is able to store, analyze, classify, and print quantitative disturbance data, accompanied by a time-of-occurence printout derived from a highly accurate crystal-controlled 24-hour clock built into the Mainframe.

NOTE

When the Series 626 Mainframe is equipped with a Model 626GP Graphics Printer, graphical disturbance data can be printed in addition to the text. (Graphical presentation of data is often easier to understand and to use when analyzing operational disturbances.)

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1.3.1 Three-Phase Monitoring

The plug-in monitors any 3-phase power line with rms (root mean square) values ranging from a low of 0 volts to a high of 600 volts. Three types of disturbances are monitored by the 6030 plug-in: power line frequency, power frequency transients, and waveform disturbances.

-- Power frequency transients are divided into five display categories:

(1) Overvoltage
(2) Undervoltage
(3) Voltage Change
(4) Voltage Surge
(5) Voltage Sag

-- Waveform disturbances, identified as "impulses" or "spikes," include all conditions that cause the power line waveform to deviate from an ideal waveform. The 6030 plug-in measures the peak amplitude of impulses and their duration. The threshold value of each type of disturbance, as well as the line frequency above which detection and printout occurs, are user-programmable. (All threshold settings are common to all three line phases.) Except for an automatic summary printout at the end of each day, disturbance data is normally printed whenever a disturbance occurs. In an alternate mode, however, a disturbance data summary printout occurs only at the end of each day. (This feature permits long-term unattended operation of the unit.)

1.3.2 Threshold Alterations

The threshold program may easily be altered by using the front panel buttons, keys, and switches. Cueing LED indicators adjacent to the programming keys simplify the programming procedure. A back-up program for the plug-in, which is stored in permanent memory at the factory, may always be recalled upon demand. Both the program and the disturbance data in the data accumulators may be printed upon demand.

NOTE

Frequency measurements are derived from phase A only, therefore, if single-phase monitoring is desired, phase A should be used.

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1.4 APPLICATIONS

When installed in the Series 626 Mainframe, the 6030 plug-in provides the capability of monitoring and evaluating power system performance. Among its typical applications are the following:

a. Determining the effect of power systems operation on equipment malfunction. Power line faults may be rapidly correlated according to errors, outages, and equipment damage in computers, industrial process controls, digital communications equipment, medical monitoring apparatus, etc. Correlation is accomplished by a time-referred fault disturbance record produced by the 6030 plug-in and printed by either the Mainframe's printer or a Graphics Printer.

b. Performing pre-installation site surveys. The 6030 plug-in can be used to determine the adequacy of existing power lines that are intended to support critical electrical equipment. (Anticipation of any power problems--before they occur--saves time, money, and future problems.)

c. Diagnostic evaluation of power system performance. The portability of the 6030 plug-in in a Mainframe makes it well suited for field use, and it is thus ideal for determining the probable causes of, and remedies for, power line disturbances.

d. Monitoring life test racks. The printouts produced by the 6030 plug-in (via the Series 626 or Graphics Printer) provide a clear record of the quality of power supplied during unattended periods of operation.

1.5 EQUIPMENT CHARACTERISTICS

The 6030 plug-in is configured as a plug-in module 6-1/2" high by 2-1/2" wide by 10" deep. It is designed for installation into the Series 626 Mainframe. The 6030 plug-in requires two of the five slots available in the Mainframe. Technical specifications for the 6030 plug-in are presented in Table 1-1.

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Table 1-1. 626-PA-6030 Technical Specifications (Page 1 of 2)

FUNCTION:	Monitor and graphically record impulses, sags, surges, undervoltages, overvoltages, and frequency variations on three channels of ac voltage.
VOLTAGE INPUT:	2-wire differential Z_{in} = 20 Megohms plus 80 pF (each side to ground)
LINE VOLTAGE MEASUREMENT:	
Range:	50 to 600V rms, 47 to 63 Hz
Resolution:	0.2V rms
Accuracy:	±1% of reading ±0.2% of F.S. (75 to 600V)
LINE FREQUENCY:	
Range:	47 to 63 Hz
Resolution:	±0.1 Hz
Accuracy:	±0.1 Hz
IMPULSE VOLTAGE MEASUREMENT:	
Range:	50 to 4000V pk (1 uSec to 2 mSec)
Resolution:	1V pk
Accuracy:	For 100V to 4000V: ±10% of reading ±1% of F.S. (5 uSec to 50 uSec.) (Decreasing to ±6 dB at 1 uSec and 2 mSec.)
IMPULSE DURATION RANGE:	1 uSec to 2 mSec
IMPULSE DURATION RESOLUTION:	1 uSec
RESOLUTION, VERTICAL:	2V on 250 volt range, 4V on 500 volt range, 8V on 1000 volt range.

cont'd

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Table 1-1. 626-PA-6030 Technical Specifications (Page 2 of 2)

SAMPLING RATE:	7.8 kHz -- 130 samples/cycle at 60Hz. -- 156 samples/cycle at 50Hz.
GRAPHICS DATA ACCURACY:	
Line Voltage:	±5% of reading ±2.5% of F.S.
Impulses:	For >100V pk, >10 uSec, ±10% of reading ±10% of F.S. Typically -6dB @ 2 uSec.
SELECTABLE THRESHOLDS:	
Low Limit:	50 to 599V rms
High Limit:	51 to 600V rms
Voltage Sensitivity (Increases and Decreases):	2 to 60V rms
Impulse:	50 to 4000V pk
Frequency Sensitivity:	0.2 to 3.0Hz (0.1Hz increm.)
Graph Full Scale:	250V pk, 500V pk, 1000V pk, or Off (No Graph)
Selectable Graph Size:	2" or 4"

1.6 STANDARD ACCESSORIES

(The model number refers to your particular 6030 plug-in model: 6030-1 or 6030-2.)

Model #	Part #	Quantity	Description
626-PA-6030-1 (Barrier-type terminal strip inputs)	TM-112975 Vol. 1	1	Operator's Manual
	(NO AC CABLES REQUIRED)		
626-PA-6030-2 (Connector inputs and mating cables)	TM-112975 Vol. 1	1	Operator's Manual
	110480	3	AC Cables

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1.6.1 Required Accessories

The required accessories for operating the 6030 plug-in (Model 6030-1 or 6030-2) are a Series 626 Mainframe and a Model 626GP Graphics Printer or any fully compatible printer (if graphic printouts are required.) Printout sizes are selectable in two or four inches square. (Two-inch printouts show slightly less detail than four-inch printouts, but print three-times as fast.)

NOTE

You may substitute a Graphics Printer with another applicable printer. (See Appendix A for further information.)

1.7 OPTIONAL ACCESSORIES

(For Model 6030-1 or 6030-2.)

Part #	Quantity	Description
TM-112975 Vol. 2	1	Service (Maintenance) Manual

You can receive the Volume 2 manual by completely filling out and returning the Control Sheet in your Series 626 Operating manual.

1.8 FACTORY REPAIR

When factory repair is required, proceed as follows:

1. Contact Dranetz Customer Service Department to obtain an authorization number for factory repair:

   Telephone No: (201) 287-3680

   TWX: (710) 997-9553

   FAX: (201) 248-9240

   Telex: 499-7808

   Cable: DRANETZ

2. Fill out the REPAIR/SERVICE ORDER form enclosed in the Series 626 Operating manual. Ship it along with the malfunctioning equipment to the Dranetz Customer Service Department.

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SECTION II
INSTALLATION AND OPERATION

2.1 GENERAL

This section contains the installation, programming, and operating instructions for the 6030 plug-in (Models -1 and -2).

2.2 LOAD RATINGS

The Series 626 standard Mainframe has an upper limit of the combined total rating of its installed modules. The overall Mainframe capacity is set at 20 units. The individual modules (existing as of this printing) have the following load ratings:

Table 2-1. Load Ratings

Plug-in	Load Rating	Plug-in	Load Rating
626-PA-6001	2 Units	626-PA-60012A	3 Units
626-PA-6001 with Extra Option Board	3 Units	626-PA-6013	2 Units
626-PA-6002	2 Units	626-PA-6014	1 Unit
626-PA-6003	4 Units	626-PA-6015	4 Units
626-PA-6005	2 Units	626-PA-6018	4 Units
626-PA-6006	2 Units	626-PA-6020	4 Units
626-PA-6007	1 Unit	626-PA-6024A	4 Units
626-PA-6008	2 Units	626-PA-6024B	4 Units
626-PA-6009	4 Units	626-PA-6025	4 Units
626-PA-6011	1 Unit	626-PA-6030	6 Units
626-PA-6012	2 Units	626-PA-6037	1 Unit
		626-PA-6038	1 Unit
		626-PA-6040	6 Units

NOTE

When selecting modules for installation into any Series 626 Mainframe, verify that the sum of the load ratings of the installed modules DOES NOT exceed 20 units.

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2.3 INSTALLATION

(Note: Two slot positions are required by the 6030 plug-in.)

To install the 6030 plug-in into the Mainframe:

WARNING

Be sure that the Series 626 Mainframe and all of the power connected to its plug-in modules are first turned OFF before proceeding with any installation.

(1) Remove the 6030 plug-in from its packaging.

(2) Position the top and bottom front corners of the plug-in module into the upper and lower tracks of two adjacent slot positions at the rear of the Series 626 Mainframe.

(3) Carefully slide the module into the Mainframe until it is firmly in position.

(4) Tighten the top and bottom captive screws in order to secure the module to the Mainframe.

2.4 CONNECTING POWER SOURCE TO MODULE

CAUTION

To avoid damaging the equipment, DO NOT apply ac voltages in excess of 600V rms to any ac phase input (A, B, or C) of the 6030 plug-in.

WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electric Code (ANSI C1), or any other requirements, or both, which may be applicable to the user.

Installation, operation, and maintenance should only be performed by qualified personnel. Your qualifications for doing so should be self-determined.

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2.4.1 Connection Procedure

The 6030 plug-in is equipped with either a barrier block connector (Model 6030-1) or three rear panel AC connectors (Model 6030-2). Inputs include phases A, B, and C. For the barrier block connectors, the terminals must be wired in accordance with the rear panel connector markings (from top to bottom: AC high, AC low, and earth ground).

(1) Turn off the Series 626 by inserting the key into the FUNCTION key switch and setting the switch to "OFF." Unplug the Mainframe from the power source.

(2) Turn off the power source that is going to be monitored by the plug-in.

(3) Make all connections to the 6030 plug-in first.

WARNING

If you are using a Model 6030-1, be sure to replace the barrier block cover after making the connections. DO NOT proceed until you have done so.

(4) Make the desired connections to the power source that is going to be monitored.

(5) Plug the Mainframe back into the power source. Turn on the Series 626 by turning the FUNCTION Key Switch to "OPERATE."

(6) Turn on the power source that is going to be monitored.

2.4.2 Circuit Applications

WARNING

Conductors connecting to measurement points should be approved for the specific use. When connected to branch circuits of 20 amperes or less, the minimum flexible cord size is No. 18 (1 mm square). For branch circuits with higher ampacity, refer to National Electric Code (ANSI CI-1975), paragraphs 240-4 and 250-95. Special consideration of ground may be required. (Refer to Article 250 of above reference if in doubt.) Outside of the United States, consult the applicable safety standards.

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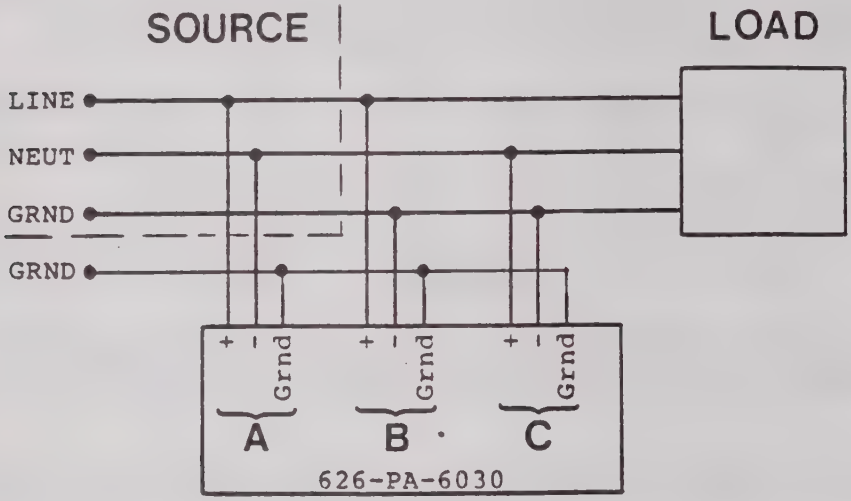
The Three-phase AC monitor for 47-63 Hz may be used by itself for Normal Mode/Common Mode analysis of 1-phase lines (illustrated in Figure 2-1), for analysis of up to three separate ac signals (illustrated in Figure 2-2), for analysis of 3-phase delta lines (illustrated in Figure 2-3), or in combination with a 626-PA-6006 to do Normal Mode/Common Mode analysis on 3-phase wye lines (illustrated in Figure 2-4).



Readings:

Channel A: Line-Neutral
Channel B: Line-Ground
Channel C: Neutral-Ground

Figure 2-1. One-Phase Normal Mode/Common Mode

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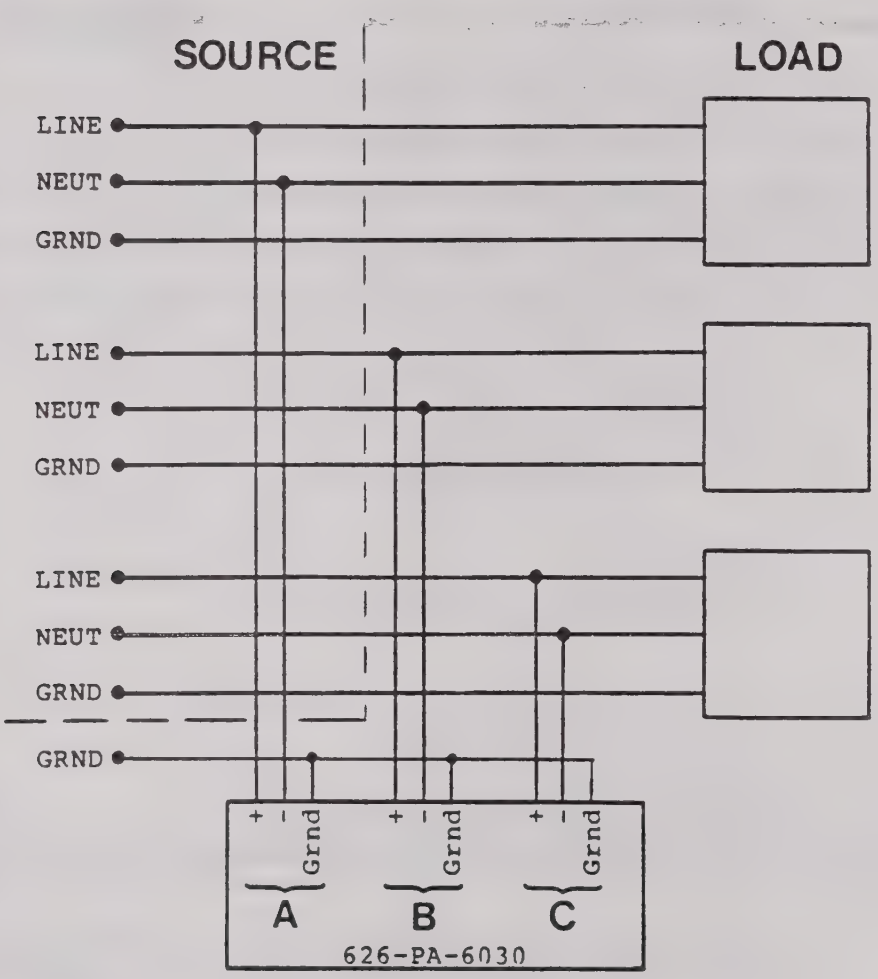

Figure 2-2. Three Separate AC Lines

Notes:

1. All channels are monitored independently.
2. All line frequencies must be the same.
3. All three channels will have the same program setup.

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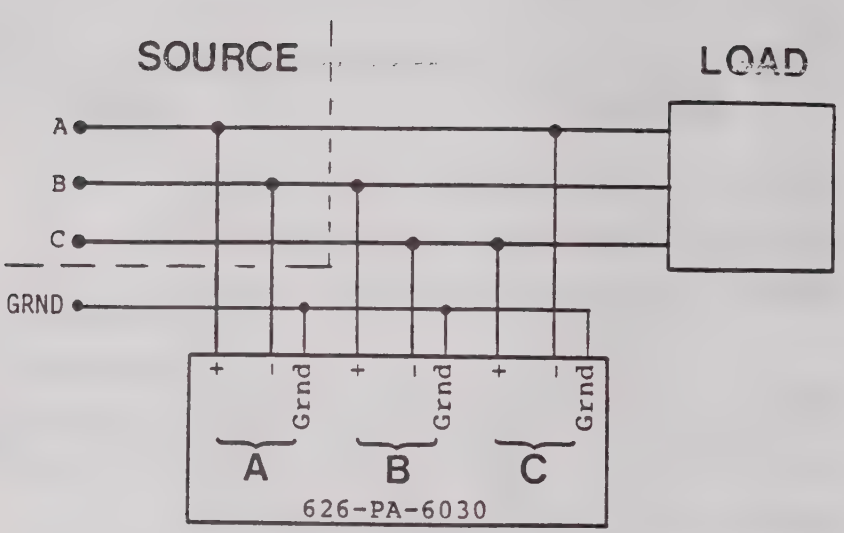

Figure 2-3. Three-Phase Delta

Notes:

1. Delta may be grounded or ungrounded.

2. Set the 6030 plug-in to monitor line-to-line voltage. For Example: For a 240 volt delta, set the High and Low limits to either side of 240V ac.

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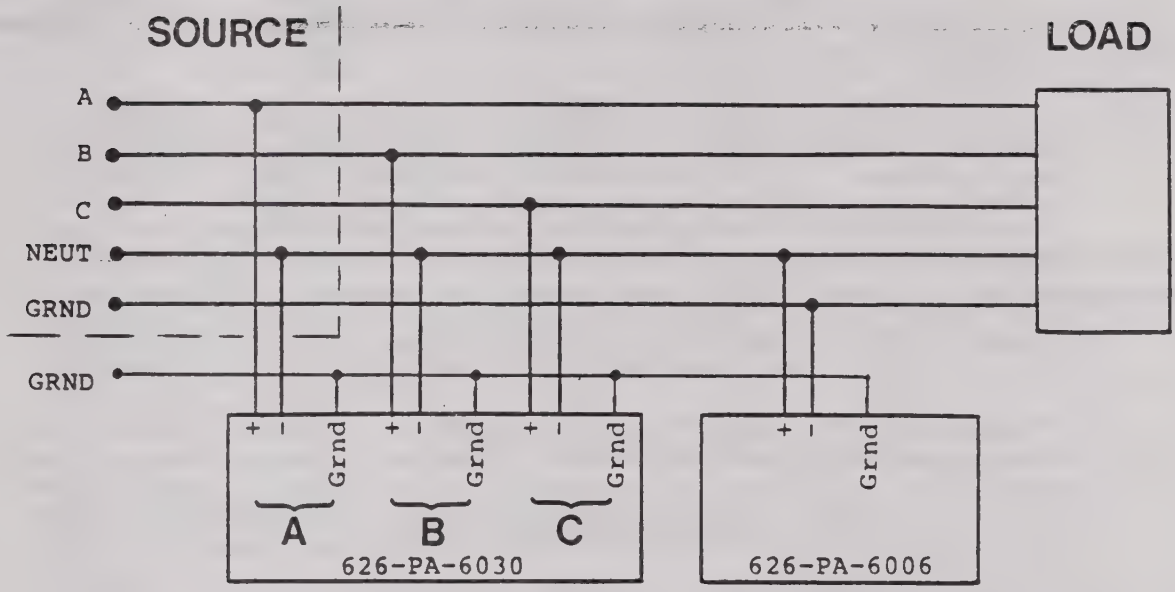

Figure 2-4. Three-Phase Wye

Notes:

1. The 6006 plug-in is added to perform Neutral-to-Ground (Common Mode) monitoring.

2. Wye distribution is normally monitored Line-to-Neutral. For Example: A 120/208 wye would be monitored with the 6030 plug-in's High and Low limits set to either side of 120V ac.

3. To monitor wye system line-to-line, set the High and Low limits to either side of the higher stated voltage. Connect the 6030 plug-in as though lines A, B, and C were from a delta. For Example: A 120/208 wye would be monitored with the 6030 plug-in's High and Low limits set to either side of 208V ac.

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2.5 MONITORING GUIDELINES

Proper monitoring and analysis of ac and dc voltage disturbances requires careful attention to the method of connection between the Series 626 Mainframe and the monitored circuit. To obtain the most accurate and relevant voltage monitoring data, follow these suggested guidelines.

(1) To minimize spurious impulse transients and interchannel coupling, always use the Dranetz test cables supplied with the Mainframe. If cables are not supplied, such as with the barrier-type terminal strip modules (Model 6030-1), the test cable should be composed of twisted-pair wires for each input channel.

(2) Test cable length should be minimized, preferably less than 8 feet from the Mainframe to the circuit connection point. This minimizes amplitude variation of impulse transients.

(3) If monitoring a power line connected to critical, sensitive load equipment, the test cable should be connected to the power line as close as possible to the load. For three-phase loads, the Mainframe should be connected in the same way as the load equipment, that is, Phase-to-Phase or Phase-to-Neutral.

(4) Use of instrument-grade Potential Transformers for monitoring impulses on high voltage power lines is not recommended. The limited frequency response of most Potential Transformers may result in substantial variation of impulse amplitude.

(5) The Mainframe is designed to operate from disturbed power lines, therefore, its power supply may be connected to the same power line that is being monitored. However, be aware that the extensive transient suppression incorporated with the Mainframe power supply may alter the transient characteristics of the ac power line that the power supply is connected to.

    To prevent alterations of the transient characteristics of the power line being monitored, separate the Mainframe's power supply input from the monitored inputs.

(6) The ground terminals of the plug-in modules are connected internally to the safety grounding conductor in the Mainframes's power plug. Be careful not to inadvertently contaminate a "clean" ground with a "dirty" ground.

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2.6 OPERATING THE 6030 PLUG-IN

2.6.1 Operating Controls and Indicators

The functions of the Mainframe operating controls and indicators associated with 6030 plug-in operation are described in Table 2-3. Figure 2-5 illustrates the typical front panel controls on a Series 626 that are associated with a 6030 plug-in. For a description of controls common to overall Series 626 operation, refer to Volume 1 of the Mainframe manual.

Table 2-3. 6030 Plug-in Operating Controls

ITEM	FUNCTION
Numerical Keys*	Used to enter numerical values for the various functions.
[LO LIMIT] Key	When pressed, enables numerical keyboard to program Low limit voltage.
[HI LIMIT] Key	When pressed, enables numerical keyboard to program High limit voltage.
[SENS] Key	When pressed, enables numerical keyboard to program voltage sensitivity threshold.
[IMP SENS] Key	When pressed, enables numerical keyboard to program frequency sensitivity threshold.
[F SENS] Key	When pressed, enables numerical keyboard to program frequency sensitivity value.
[ENTER] Key	When pressed, transfers the entered numerical value into the plug-in's memory.
[CLEAR ENTRY] Key	When pressed, cancels the current numerical sequence being entered.
[RANGE] Key	When pressed, enables numerical keyboard to program the full scale range of the graphs produced by an attached printer; also, allows selection of 2" or 4" graph size.
[PROG] Button*	Produces Prog. Summary printout when pressed.
[DATA] Button	Produces Data Summary printout when pressed.
[PRESET] Button	With FUNCTION key switch set to "PROGRAM," pressing [PRESET] recalls the non-volatile "Factory Preset" program for the last channel pressed or currently depressed.

* -"Key" and "Keyboard" represent the red, green, and yellow keys; "Button" represents the black selector buttons.

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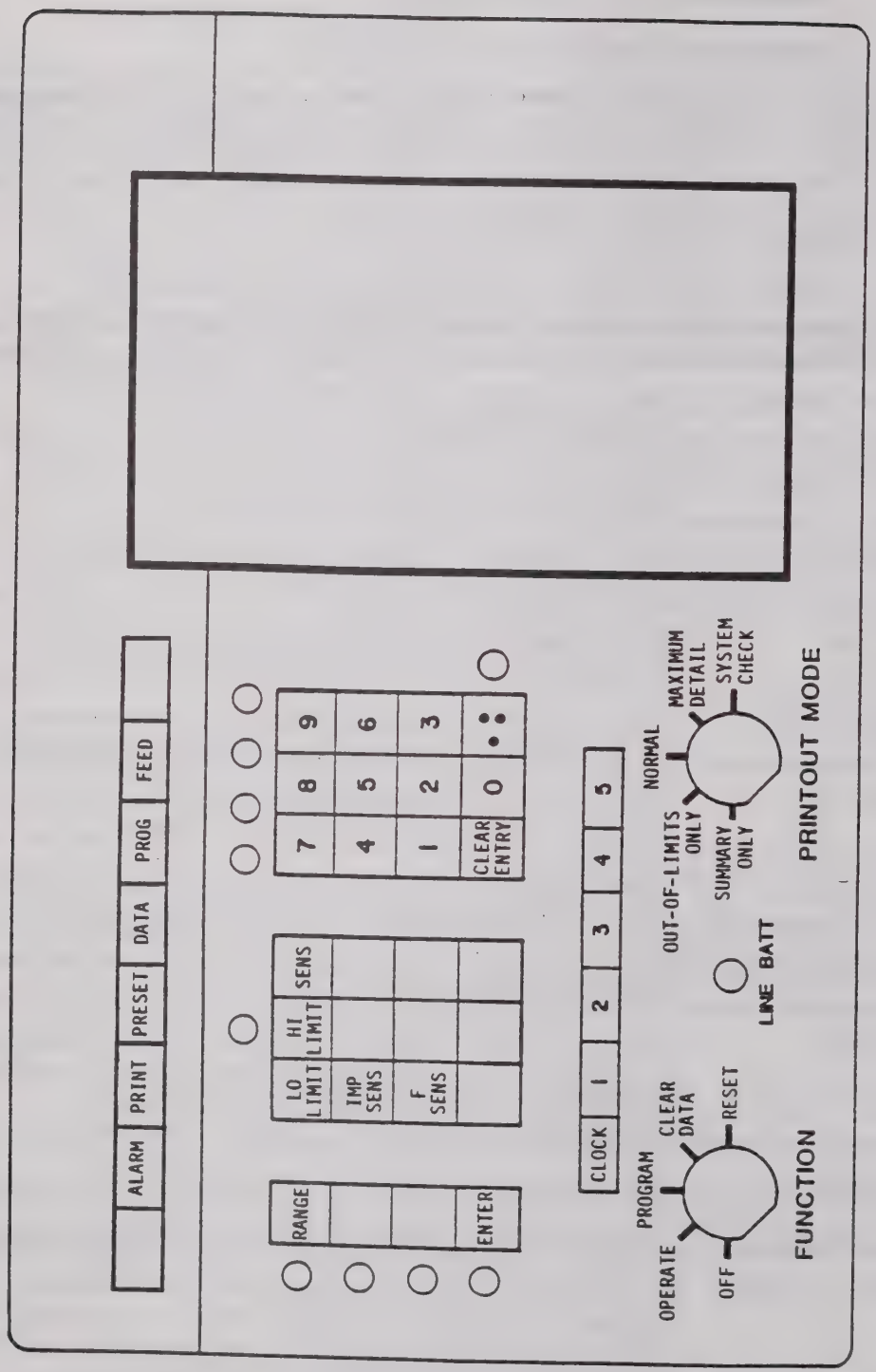

Figure 2-5. Series 626 Controls used by the 6030 Plug-in

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2.6.2 Programming Procedure

The easiest and clearest way to learn the programming of the 6030 plug-in is through an illustrated example.

Assume it is desired to program:

-- A graph size of 2 inches,
-- a full scale graph range of 250V,
-- a high limit of 125V,
-- a low limit of 105V,
-- a voltage sensitivity of 2V,
-- a frequency sensitivity of 0.2Hz,
-- and an impulse sensitivity of 50V.

The voltage and frequency sensitivities set the deviation from the present value, above or below which a detected value produces a recorded disturbance.

For impulse measurements, the sensitivity corresponds to the absolute threshold, so that for an impulse sensitivity of 50 volts, a disturbance is recorded when the impulse amplitude rises above 50 volts.

NOTES

1) It is recommended that the high and low limits be set to at least 3V (respectively) from the nominal voltage being measured. For example, if monitoring 120V, the high limit should be set to at least 123V and the low limit to at most 117V.

2) It is also recommended that the sensitivity be set to 2% or higher of the nominal input voltage.

For this example, program the 6030 plug-in as follows:

(1) Set the FUNCTION key switch to "PROGRAM"; set the PRINTOUT MODE key switch to "NORMAL."

(2) Since the 6030 plug-in occupies two slots, push the lower of the two black buttons of the two slots being occupied (for example, [2], when slots 2 and 3 are occupied.) Note that a Program Summary for that channel is immediately printed.

(3) The cueing indicator above the left bank of keys lights, indicating that [RANGE] should now be pressed.

(4) Press [RANGE]. A printout such as the one on the top of the next page will be printed. Press [1] on the keyboard to select the 2" graph size and then press [ENTER].

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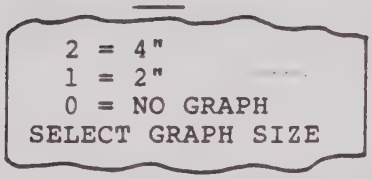
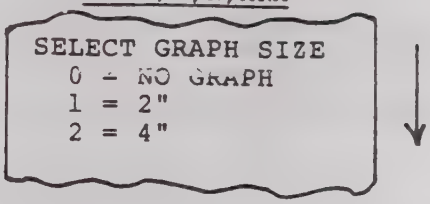
The menu mentioned in step (4) appears as follows:

626

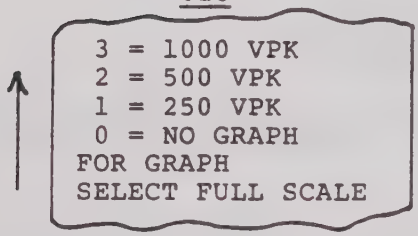


626A,G,R,ARA

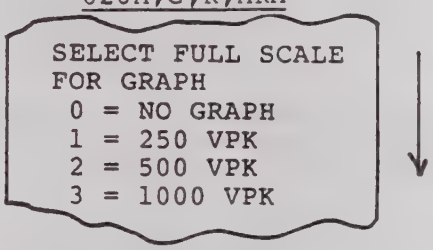


(5) The following menu will then be printed:

626



626A,G,R,ARA



(6) Press [1] and [ENTER] to select the 250V range.

(7) Press [HI LIMIT]. Program the high limit value (125) using the keyboard to type the numerical entries.*

NOTE

The instrument is designed to detect an invalid entry and to automatically shift high and low limits.

(8) When the ENTER LED lights, press [ENTER]. The programmed high limit will be echoed back on the printout and the ENTER LED will go out.

(9) Press [LO LIMIT] and program the low limit value (105) using the keyboard to type the numerical entries, followed by [ENTER]. The programmed low limit will be echoed back on the printout and the ENTER LED will go out.

(10) Press [SENS] and program the voltage sensitivity (02) using the keyboard to type the numerical entries, followed by [ENTER]. The programmed voltage sensitivity will be echoed back on the printout and the ENTER LED will go out.

---

* -If an incorrect entry is made, press [CLEAR ENTRY] and the current sequence of numerical entries will be erased, allowing the correct sequence to be retyped.

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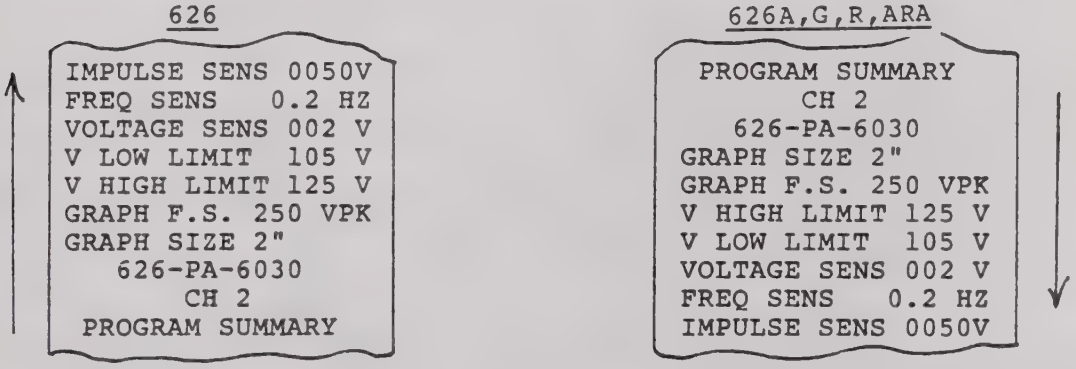
(11) Press [F SENS] and program the frequency sensitivity (0.2), using the numerical keyboard to type the numerical entries, followed by [ENTER]. The programmed frequency sensitivity will be echoed back on the printout and the ENTER LED will go out.

(12) Press [IMP SENS] and program the impulse sensitivity (0050), using the numerical keyboard to type the numerical entries, followed by [ENTER]. The programmed impulse sensitivity will be echoed back on the printout and the ENTER LED will go out.

(13) Press [PROG] to obtain a Program Summary printout for verification.

The completed program printout should appear as follows:



(14) When the plug-in program is completed, you can proceed to program another module (by pressing another channel number), or you can place the instrument on-line by setting the FUNCTION key switch to "OPERATE." While on-line, the Program Summary of program in effect may be obtained by simply pressing the [PROG].

2.6.3 Selecting the Factory Preset (Option 101) Program

Option 101 is built into your Series 626 Mainframe. This option lets you use the PRESET command to recall the factory preset setups from the 6030 plug-in's memory.

(1) To select the program stored in the Mainframe's permanent memory, set the FUNCTION key switch to "PROGRAM" and press the desired channel number. The last Operator-set program will be printed as illustrated on the next page.

(2) Press [PRESET] to recall the Factory Preset program. An example of this sequence appears on the next page. In the example, the differences in the Operator's and Factory Preset programs are listed at the top of the next page.

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	Operator's	Factory Preset
Impulse Sensitivity:	50V	100V
Frequency Sensitivity:	0.2Hz	0.5Hz
Graph F.S:	500V pk	250V pk
Graph Size	2"	4"

626

```
IMPULSE SENS 0100V
FREQ SENS  00.5 HZ
VOLTAGE SENS  002V
V LOW LIMIT  105 V
V HIGH LIMIT 125 V
GRAPH F.S.  250VPK
GRAPH SIZE 4"
   626-PA-6030
      CH 2
 PROGRAM SUMMARY


IMPULSE SENS 0050V
FREQ SENS  00.2 HZ
VOLTAGE SENS  002V
V LOW LIMIT  105 V
V HIGH LIMIT 125 V
GRAPH F.S.  500VPK
GRAPH SIZE 2"
   626-PA-6030
      CH 2
 PROGRAM SUMMARY
```

OPERATOR'S MANUAL

626A,G,R,ARA

```
 PROGRAM SUMMARY
      CH 2
  626-PA-6030
GRAPH SIZE 2"
GRAPH F.S.  250VPK
V HIGH LIMIT 125 V
V LOW LIMIT  105 V
VOLTAGE SENS  002V
FREQ SENS  00.2 HZ
IMPULSE SENS 0100V


 PROGRAM SUMMARY
      CH 2
  626-PA-6030
GRAPH SIZE 4"
GRAPH F.S.  250VPK
V HIGH LIMIT 125 V
V LOW LIMIT  105 V
VOLTAGE SENS  002V
FREQ SENS  00.5 HZ
IMPULSE SENS 0100V
```

2.7 DESCRIPTION OF DATA PRINTOUTS

When any of the disturbances described below is detected by the 6030 plug-in, it is recorded and displayed in the listed manner. In addition, if the Graphics Printer (or similar) is connected, graphical disturbance printouts will also be obtained. The printouts of Subsections 2.7.1 through 2.7.6 represent printouts that would be obtained by either the Mainframe's printer or by a connected Graphics Printer. If a Graphics Printer were connected, waveforms of the disturbances would also be displayed (in 2" or 4" sizes, as desired).

NOTES

If a Graphics Printer (or similar) is connected, you should disable the Mainframe's printer, since its display is repetitive with the Graphics Printer's display. Pressing [PRINT] will disable the Mainframe's printer; pressing [PRINT] again (toggle button) re-enables it.

In disturbance printouts of subsections 2.7.1 through 2.7.5, voltage levels are based on waveform rms values.

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2.7.1 Overvoltage

An overvoltage condition exists when the monitored power line voltage exceeds the user-specified upper limit for more than 2.55 seconds. An overvoltage condition is indicated by a printout such as the following:

```
4B  HI  09:46:07.11
```

where 4 is the channel number, B is the phase, and time is given in hours, minutes, and seconds (to the 0.01 second resolution).

When the line voltage returns to normal (within limits), a printout such as the following occurs:

626

```
4B  NOR  09:46:15.20
    148.6  V  MAX
```

626A,G,R,ARA

```
    148.6  V  MAX
4B  NOR  09:46:15.20
```

The printout indicates the time when normal voltage was restored and the highest voltage reached during the overvoltage interval.

2.7.2 Undervoltage

An undervoltage condition exists when the monitored power line voltage remains below the user-specified lower limit for more than 2.55 seconds. An undervoltage condition is indicated by a printout such as the following:

```
4C  LO  09:46:15.20
```

When the line voltage returns to normal (within limits), a printout such as the following occurs (see next page):

626

```
4C  NOR  09:46:18.45
    36.4  V  MIN
```

626A,G,R,ARA

```
    36.4  V  MIN
4C  NOR  09:46:18.45
```

The printout indicates the time when normal voltage was restored and the lowest voltage reached during the undervoltage condition.

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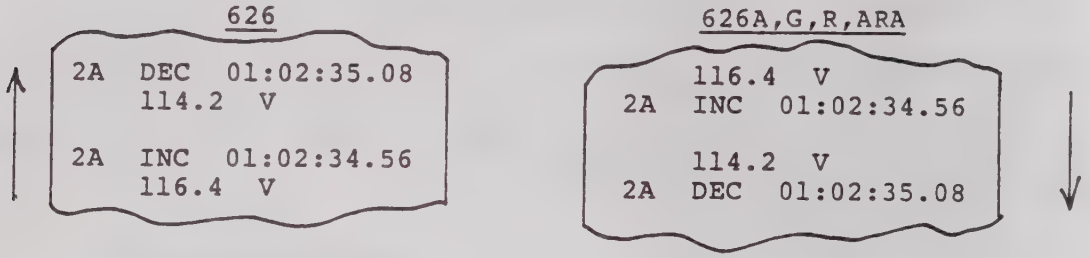
2.7.3 Voltage Change

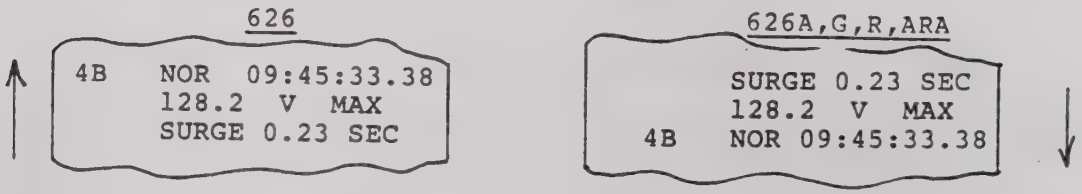
A voltage change printout is triggered when the line voltage changes more than a preselected amount from the last printed value. The voltage change sensitivity is a user-selected integer voltage between 2 and 60 volts. The following example shows an increase to 116.4 volts followed by a decrease to 114.2 volts at the times shown (assume 2V sensitivity).



2.7.4 Voltage Surge

A Voltage Surge is defined as a line voltage which increases through a user-selected upper limit and then returns to an in-tolerance condition in less than 2.56 seconds. When a surge begins, its starting time is printed as follows:

When the line voltage returns to a normal level following a Surge condition, a message such as the following is printed:



The printout indicates the time when the voltage returned to normal (within limits), as well as the highest voltage reached and the surge duration.

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2.7.5 Voltage Sag

A voltage Sag is defined as a line voltage that decreases below the user-selected lower limit and then returns to an in-tolerance condition in less than 2.56 seconds. Sag printouts take the same form as surge printouts, with the terms SAG replacing SURGE, MIN replacing MAX, and LO replacing HI. When a sag begins, its starting time is printed as follows:

```
4B   LO  09:45:34.25
```

When the line voltage returns to a normal level following a Sag condition, a message such as the following is printed:

626

```
4B   NOR  09:45:34.40
     102.2  V  MIN
     SAG  0.26 SEC
```

626A,G,R,ARA

```
     SAG  0.26 SEC
     102.2  V  MIN
4B   NOR 09:45:34.40
```

NOTE

Voltage inputs of less than 25V rms will be printed as 0.0V by the 6030 plug-in.

2.7.6 Impulses

"Impulse" disturbances represent any line perturbation which contains frequency components in the 300 Hz to 500 kHz range. An impulse-type disturbance produces a printout such as the following:

626

```
2A IMP 10:12:13.45
  0139 V, 0010 US
```

626A,G,R,ARA

```
  0139 V, 0010 US
2A IMP 10:12:13.45
```

The printout indicates that an impulse which deviated from normal line voltage by 139 volts, peak, and with a 10 microsecond duration, was detected on phase A of Channel 2 at the time shown. The impulse magnitude is measured with respect to the instantaneous point on the power frequency sine wave where it occurs.

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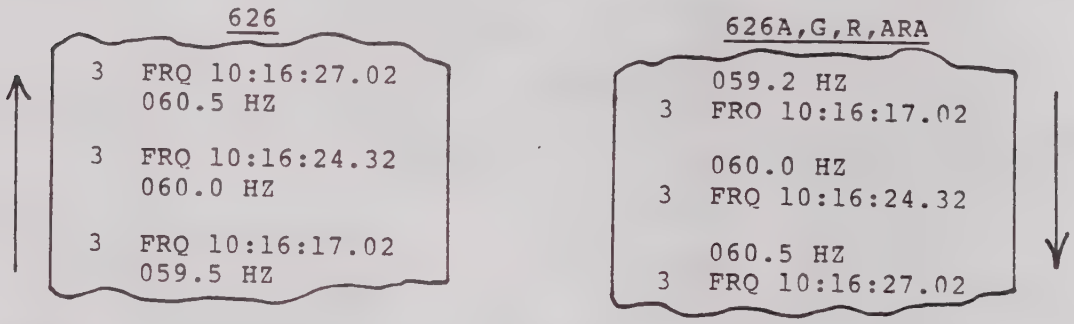
2.7.7 Frequency Change

A frequency change printout is triggered whenever the line frequency changes by more than a preselected amount from the last printed value. The frequency change sensitivity is a user-selected value between 0.2 Hz and 3.0 Hz (in 0.1Hz increments). The following example shows several frequency change printouts (assume a frequency sensitivity of 0.5Hz).



NOTE

When using a Graphics Printer, a frequency change disturbance will not cause a corresponding graph to be printed.

2.8 DESCRIPTION OF GRAPHIC PRINTOUTS

(Refer to the Graphics Printer Operator's manual for more information on operating your 6030 plug-in with a Graphics Printer.)

With the Model 626GP Graphics Printer attached, graphs will be plotted for each disturbance as long as there is sufficient memory to store the event.

NOTE

If two or more disturbances on the same phase are recorded with the same time signature, only one graph will be entered.

The memory in the 6030 plug-in is capable of storing twelve cycles worth of data. Since three cycles are required for each graph, four graphs can always be printed and as many as 10 may possibly be printed. (The exact number of graphs stored cannot be determined since it is affected by the number of disturbances and the time elapsed between them.)

When the graphic memory is full, the 6030 plug-in will continue monitoring and printing disturbances, but in text only. The graphical printouts will resume when there is sufficient free memory.

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2.9 VARIOUS PRINTOUT MODES

The setting of the PRINTOUT MODE key switch on the front panel of the Series 626 Mainframe determines the amount of detail which is printed from any disturbance. The further clockwise the key is turned, up to the SYSTEM CHECK position, the more detail that is printed regarding a disturbance. Below is a list of the four key switch positions and the amount of detail printed when the PRINT-OUT MODE key is in each position.

SUMMARY ONLY

The Series 626 printer and Graphics Printer are both inhibited. All data acquired by the 6030 plug-in is stored in the Series 626's daily accumulator. A daily summary is printed at midnight (Series 626 time), or when the black [DATA] button is pressed.

OUT-OF-LIMITS-ONLY

Disturbance data is ONLY printed when the disturbance is recorded as out-of-limits (the averaged sensitivity deviations such as voltage and frequency changes are not printed).

NORMAL

A moderately detailed printout of any disturbances recorded by the 6030 plug-in is printed.

MAXIMUM DETAIL

A highly detailed printout of any disturbances recorded by the 6030 plug-in is printed. When printing graphs, all three phases are graphed for each disturbance.

2.9.1 Example Printouts using a Graphics Printer

The printouts of the following subsections illustrate some of the various printouts obtained when disturbances are recorded by the 6030 plug-in. The waveforms were printed by a Graphics Printer. It is assumed that the limits were programmed as follows:

Graph F.S: 250V pk (Size: 4")	Voltage Sensitivity: 20V
Voltage High Limit: 125V	Frequency Sensitivity: 0.5Hz
Voltage Low Limit: 105V	Impulse Sensitivity: 100V

NOTE

Disturbances which occur while the PRINTOUT MODE switch is in the "SUMMARY ONLY" position do not generate individual printouts, but are stored in the daily accumulator and are automatically printed each day at midnight (worst case event and number of occurrences in each category). This printout may also be triggered manually by pressing the [DATA] button.

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2.9.1.1 Impulse Disturbance Printout

Figure 2-6 below is a printout of an Impulse (spike) of 355 volts which lasted 13 microseconds. The printout would be the same in the Out-Of-Limits Only, Normal, and Maximum Detail Modes. If a Graphics Printer were not used, the Mainframe's printer would simply print:

However, with a Graphics Printer installed, not only is the text printed but the waveform as well:

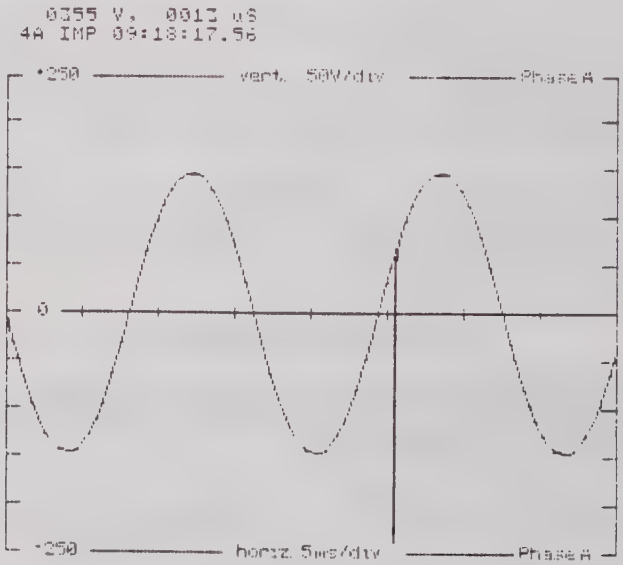

Figure 2-6. Impulse Waveform Printed by the Model 626GP

2.9.1.2 Surge Disturbance Printout

Figure 2-7 is a printout of a Surge which lasted 0.35 seconds and reached a maximum of 138.0 volts. The printout of Figure 2-7 would occur in the Out-of-Limits Only Mode--a waveform is printed when the voltage goes out of limits and another is printed when the voltage returns to normal (within limits). If the PRINTOUT MODE key switch were set to "NORMAL," every increase or decrease of the voltage (exceeding the 20V threshold) would also trigger a disturbance printout and a graph. If the PRINTOUT MODE key switch were set to "MAXIMUM DETAIL," all three phases (A, B & C) would be printed whenever a disturbance is detected (increases and decreases included).

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Without a Graphics Printer, the Mainframe's printer would print:

626

```
3A NOR 10:20:55.99
   138.0 V MAX
   SURGE 0.35 SEC

3A INC 10:20:55.64
   134.0 V
3A HI  10:20:55.64
```

626A,G,R,ARA

```
3A HI  10:20:55.64

   134.0 V
3A INC 10:20:55.64

   SURGE 0.35 SEC
   138.0 V MAX
3A NOR 10:20:55.99
```

However, if a Graphics Printer were installed the following would be printed (note that the waveform partially overlaps itself):

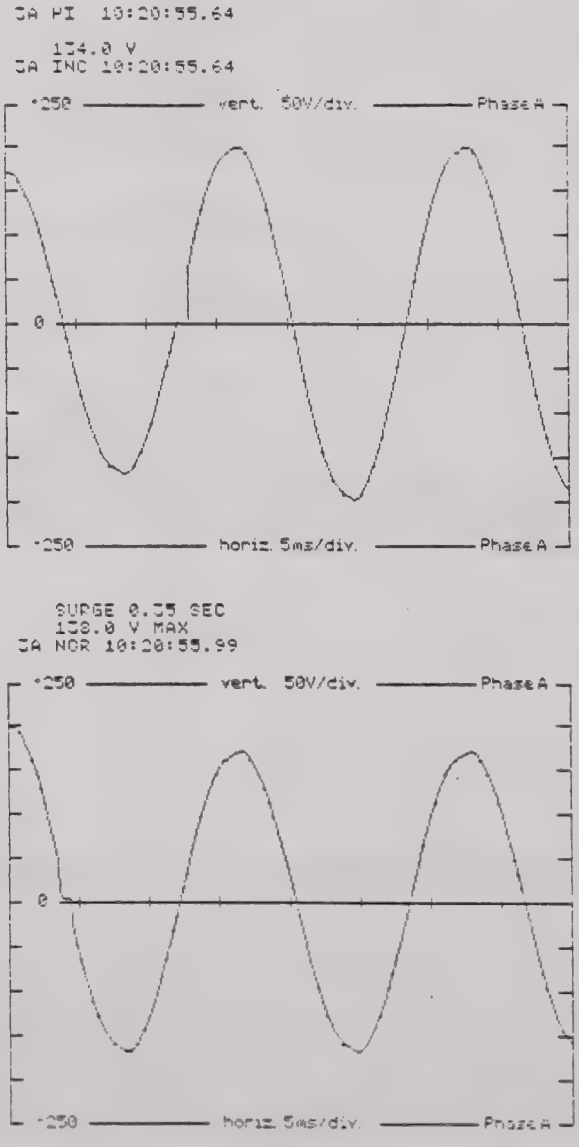

Figure 2-7.

Surge Waveform Printed by the Model 626GP

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2.9.1.3 Overvoltage Disturbance Printout

Because an Overvoltage disturbance "HI" waveform is nearly identical to a Surge waveform, an example printout is not presented. The only difference in the text would be that the duration of the disturbance would be more than 2.55 seconds (by definition).

2.9.1.4 Sag Disturbance Printout

Figure 2-8 is a printout of a Sag which lasted 0.35 seconds and reached a minimum of 78.6 volts. The printout would occur in the Normal Mode--a waveform is printed when the voltage goes out of limits, each time it crosses the voltage sensitivity threshold of 20V, and finally when the voltage returns to within limits.

Without a Graphics Printer, the Mainframe's printer would print:

626

```
3A NOR 09:58:21.63
   078.6 V MIN
   SAG   0.35 SEC

3A INC 09:58:21.61
   099.0 V

3A DEC 09:58:21.28
   079.0 V

3A LO  09:58:21.28
```

626A,G,R,ARA

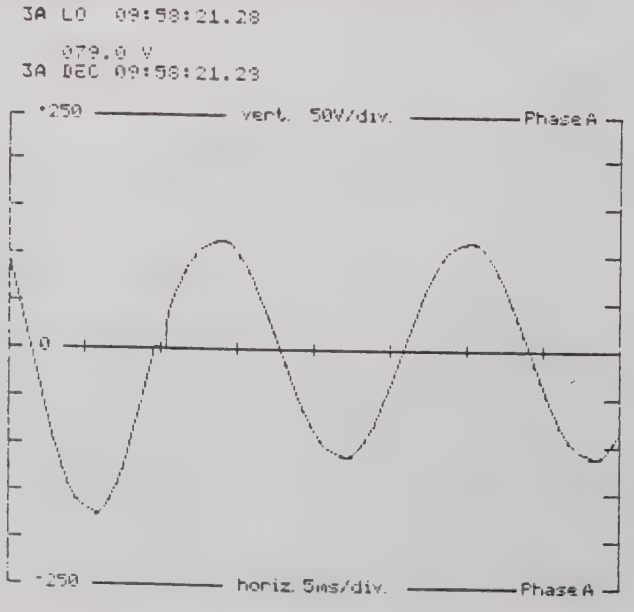
```
3A LO  09:58:21.28

   079.0 V
3A DEC 09:58:21.28

   099.0 V
3A INC 09:58:21.61

   SAG   0.35 SEC
   078.6 V MIN
3A NOR 09:58:21.63
```

However, if a Graphics Printer were installed the following would be printed (note that the waveform partially overlaps itself):



(Cont'd)

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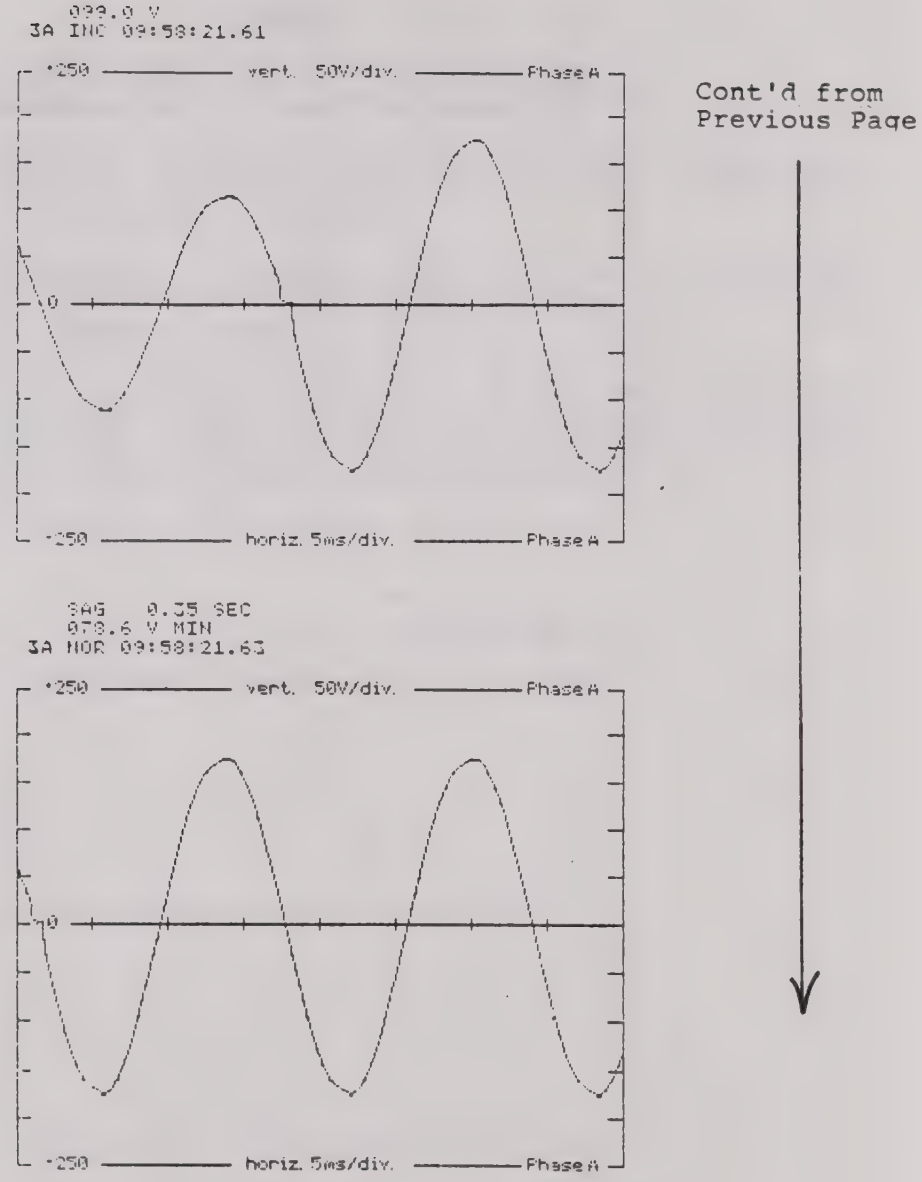

Figure 2-8. Sag Waveform Printed by the Model 626GP

2.9.1.5 Alternate Example of a Sag Disturbance Printout

While a sag is often gradual (as indicated in Figure 2-8), there are times when a sag can be an abrupt dropout. Having a waveform graph of the disturbance, such as that in Figure 2-9, makes it easier to visualize an abrupt disturbance. (Note that the waveform partially overlaps itself.)

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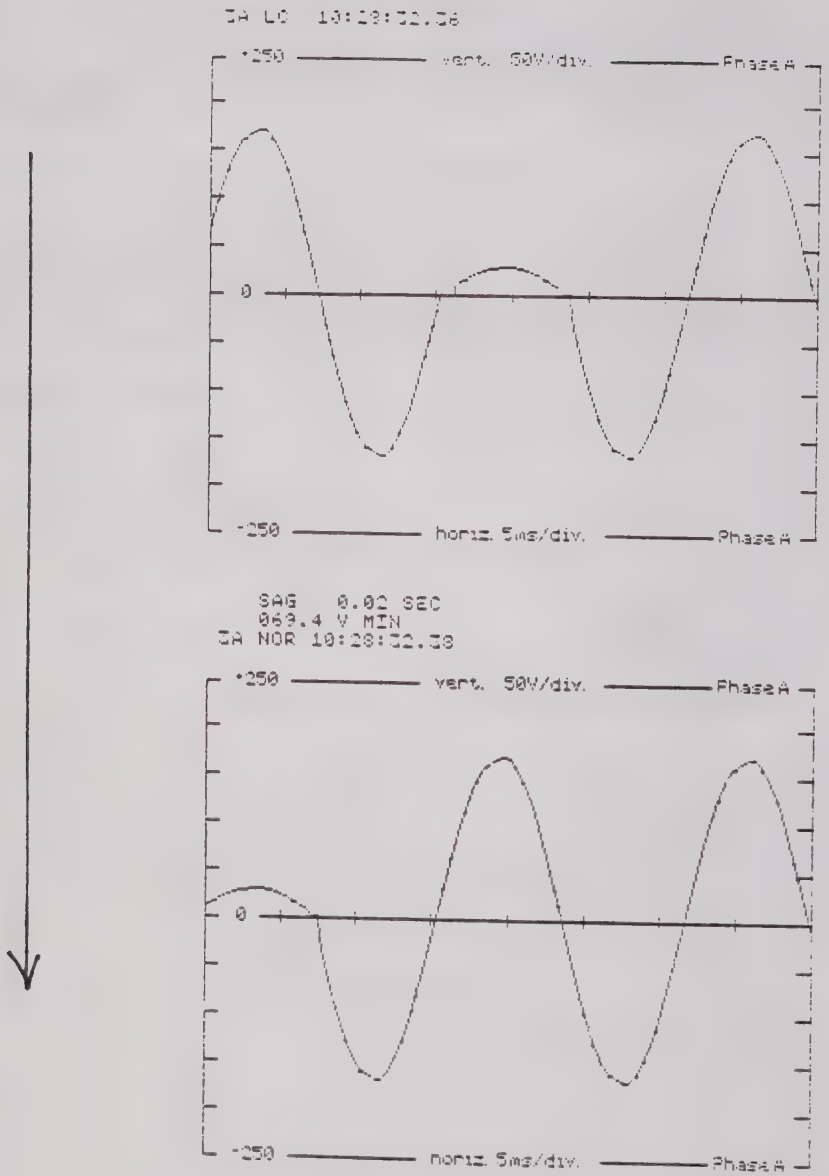

Figure 2-9. Alternate Sag Waveform Example

2.9.1.6 Undervoltage Disturbance Printout

Because an Undervoltage disturbance "LO" waveform is nearly identical to the Sag waveform, an example printout is not presented. The only difference in the text would be that the duration of the disturbance would be more than 2.55 seconds (by definition).

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2.10 AUTOMATIC GRAPH SUPPRESSION

NOTE

This subsection applies to 6030 plug-ins with Version 2.8 or later software.

For 6030 plug-ins with Version 2.8 or later software, there will be occasions when a graph is not printed for an event, even though there is empty memory available.

A graph will be suppressed (deleted) when the plug-in determines that the graph will contain no additional information other than that found in the previous graph.

This condition will only occur when part of the suppressed graph overlaps the previous graph within 20 milliseconds. This will most likely occur if the monitored power line drops out, an impulse occurs, and the line then returns to normal.

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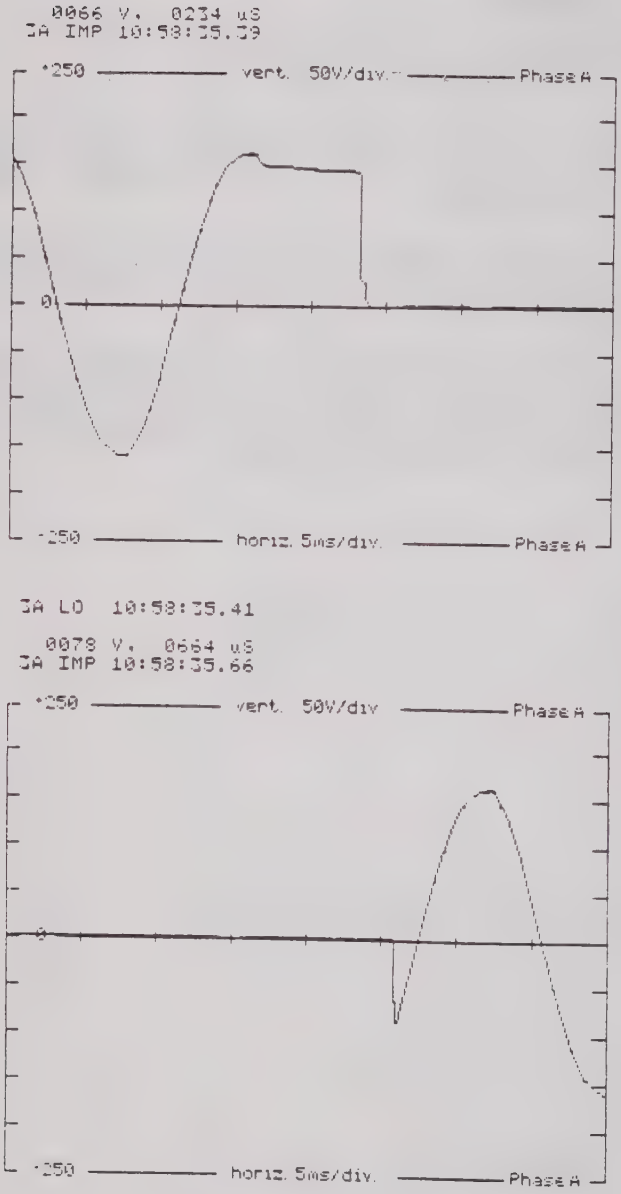

A graph which would just show the continuation of the zero voltage dropout is suppressed from being printed here.

Figure 2-10. Suppressed Graph Example

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SECTION III
OPERATIONAL TEST

3.1 GENERAL

This section provides information for performing an operational test to verify that the 6030 plug-in is operating properly.

3.2 SYSTEM CHECK

(1) Turn the PRINTOUT MODE key momentarily to the "SYSTEM CHECK" position, and then back to "NORMAL."

When the PRINTOUT MODE key switch is turned to "SYSTEM CHECK," a source of precise signals is applied to the front-end circuitry of the 6030 plug-in. Any inputs connected at this time will be automatically disconnected during the system check period. Successful measurement of these signals verifies that the plug-in module is fully operational.

(2) Compare the actual displayed readings with those is subsection 3.2.1 below. If any readings are out of range, contact Dranetz Customer Service Department for further instructions (see subsection 1.8, FACTORY REPAIR.)

3.2.1 System Check Tolerances

AC Voltage ..... 196.0 to 204.0 Volts

Impulse Peak ..... 1800 to 2200 Volts

Impulse Duration ... 8 to 12 Microseconds

Frequency ..... 59.8 to 60.2 Hertz

3.2.2 Example System Check Printout

The display on the following page illustrates an example System Check printout of a 6030 plug-in.

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626

```
******************

IMP- 2195V,    10US
AC VOLTS     200.0V
        PH C
IMP- 2185V,    10US
AC VOLTS     200.4V
        PH B
IMP- 2110V,    11US
AC VOLTS     201.6V
        PH A
FRQ     60.0 HZ
    626-PA-6030
        CH 1

05/30/86  14:53:25
***SYSTEM CHECK***
```

626A,G,R,ARA

```
***SYSTEM CHECK***
05/30/86  14:53:25

        CH 1
    626-PA-6030
FRQ     60.0 HZ
        PH A
AC VOLTS     201.6V
IMP- 2110V,    11US
        PH B
AC VOLTS     200.4V
IMP- 2185V,    10US
        PH C
AC VOLTS     200.0V
IMP- 2195V,    10US

******************
```

The above printout verifies the operational integrity of the 6030 plug-in for all three measurement phases (A, B, and C). The plug-in passes the System Check because all values are within the tolerances of Subsection 3.2.1.

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APPENDIX A

A.1 GENERAL

The Series 626 Mainframe's front panel printer cannot produce graphic displays, therefore, another printer must be used when graphs are required. The 6030 plug-in is designed to be used in conjunction with the Dranetz Model 626GP Graphics Printer, however, it is also possible to use the 6030 plug-in with other printers. The information in the following subsections provides information on how to use the plug-in with and Epson FX-100+ (or compatible) printer.

A.2 TRANSMISSION OF GRAPHICS DATA

Graphics data is only available at the Series 626 Mainframe's RS-232C port which is located on its rear panel (DCE Communications port, connector J2).

When transmitting graphics information, the data format is:

-- 8 bits,
-- no parity,
-- and 2 stop bits.

DTR handshaking is used on the Series 626. The control codes used by the 6030 plug-in are Epson FX-100+ compatible as listed in the following examples. In the examples, "$" indicates a hexadecimal number and "CHR$( )" indicates a character string, not an ASCII character. ASCII characters are indicated by "A", "K", "0", "ESC", etc.

NOTE

The Series 626 Mainframe's Communications Port must be set to at least 1200 baud, its default, or else the time it will take to print graphs will be impracticle.

Control Codes used by the
Graphics Printer and Epson FX-100+ Printer

Control Codes for Line Spacing:

"ESC","0" = $1B,$30 --- Sets line spacing for text mode.

"ESC","A",CHR$(8) = $1B,$41,$08 --- Sets line spacing for graphics mode, line spacing is approximately 8/72 inch standard.

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Control Codes for Dot Graphics:

"ESC","K",CHR$(n1),CHR$(n2) --- Turns on graphics mode where n1,n2 form a 16-bit binary number indicating the number of graphics columns to print. The lsb is n1=n(MOD 256); the msb is n2=INT(n/256)

For Example: To send 320 columns of graphics, the following string of characters would be transmitted:

"ESC","K",CHR$(64),CHR$(1) = $1B,$4B,$40,$01

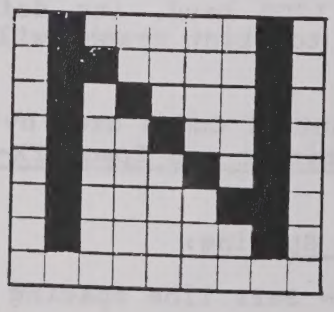
Graphics columns are encoded as follows:

The TRUE state of "1" causes a dot to be printed. The least significant bit (lsb) of the number transmitted controls the lowest dot of the 8-dot column. The most significant bit (msb) of the number transmitted controls the highest dot of the 8-dot column.

For Example: The graphic string:

$00,$FE,$40,$20,$10,$08,$04,$FE,$00

would print the letter "N" as illustrated below.



MP MASTER
MA23078

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